

CLAIMS

What is claimed is:

1 1. A liquid crystal display device, comprising:
2 an upper electrode;
3 a lower electrode;
4 an alignment layer in contact with either of said upper electrode or said
5 lower electrode to form a lower assembly and an upper assembly;
6 and
7 a liquid crystal display material, disposed between the upper assembly
8 and the lower assembly;
9 wherein the upper assembly and the lower assembly are designed relative
10 to each other, based on at least one surface potential
11 measurement, to create a substantially predetermined surface
12 potential difference between the upper assembly and the lower
13 assembly;
14 such that an intrinsic DC offset potential in said liquid crystal display
15 device is within a designed range.

1 2. A liquid crystal display device, as in claim 1, wherein material is selected
2 for said lower electrode and said upper electrode, such that a surface potential
3 difference between the lower assembly and the upper assembly, is adjusted and
4 the intrinsic DC offset potential in said liquid crystal display device is changed.

1 3. A liquid crystal display device, as in claim 1, wherein material for said
2 lower electrode is selected for the lower assembly, the material for said lower
3 electrode having a measured surface potential and material for said upper
4 electrode is selected for the upper assembly of said liquid crystal display device,
5 the material for said upper electrode having a surface potential that is
6 substantially similar to a surface potential of the material for said lower electrode.

1 4. A liquid crystal display device, as in claim 1, wherein at least one of said
2 upper electrode and said lower electrode, is treated such that a surface potential

- 3 difference between the lower assembly and the upper assembly, of said liquid
- 4 crystal display device, is adjusted and the intrinsic DC offset potential is
- 5 changed.

- 1 5. A liquid crystal display device, as in claim 4, wherein, at least one of said
- 2 upper electrode and said lower electrode is treated by firing in an atmosphere
- 3 selected from the group consisting of H₂, N₂, and combination H₂/N₂.

- 1 6. A liquid crystal display device, as in claim 4, wherein at least one of said
- 2 upper electrode and said lower electrode is treated by etching.

- 1 7. A liquid crystal display device, as in claim 1, wherein at least one of said
- 2 upper electrode and said lower electrode is treated, such that a surface potential
- 3 of at least one of said upper electrode and said lower electrode is changed.

- 1 8. A liquid crystal display device, as in claim 1, wherein passivation layer
- 2 material is selected and disposed on at least one of said upper electrode and
- 3 said lower electrode to form at least one of the lower assembly and the upper
- 4 assembly wherein a surface potential of an assembly formed thereby is altered,
- 5 such that a surface potential difference between the lower assembly and the
- 6 upper assembly is adjusted and the intrinsic DC offset potential in said liquid
- 7 crystal display device is changed.

- 1 9. A liquid crystal display device, as in claim 8, wherein the surface potential
- 2 of the assembly formed thereby is altered, resulting in a decrease in the surface
- 3 potential.

- 1 10. A liquid crystal display device, as in claim 8, wherein the surface potential
- 2 of the assembly formed thereby is altered, resulting in an increase in the surface
- 3 potential.

- 1 11. A liquid crystal display device, as in claim 1, wherein a passivation layer is
- 2 selected from at least one of BCB, NHC, MgO, SiO₂, Al₂O₃, SiN₂, MgF₂, and

3 MgAl₂O₄ and the passivation layer is disposed on at least one of said upper
4 electrode and said lower electrode to form an assembly, wherein the way the
5 passivation layer is disposed is selected from at least one of sputtering by
6 chemical vapor deposition (CVD), plasma-enhanced CVD, evaporation, spin-
7 coating, meniscus and roller-coating; such that a surface potential difference
8 between the assembly formed thereby and a second assembly of said liquid
9 crystal display device, is adjusted.

1 12. A liquid crystal display device, as in claim 11, wherein the passivation
2 layer is selected and disposed on at least one of said upper electrode and said
3 lower electrode to form the second assembly.

1 13. A liquid crystal display device, as in claim 1, wherein materials for said
2 alignment layer are selected and disposed on at least one of said upper
3 electrode and said lower electrode to form an assembly wherein a surface
4 potential of the assembly is altered, such that a surface potential difference
5 between the lower assembly and the upper assembly is adjusted and the
6 intrinsic DC offset potential in said liquid crystal display device is changed.

1 14. A liquid crystal display device, as in claim 13, wherein the surface
2 potential of the assembly formed thereby is altered, resulting in a decrease in the
3 surface potential.

1 15. A liquid crystal display device, as in claim 13, wherein the surface
2 potential of the assembly formed thereby is altered, resulting in an increase in
3 the surface potential.

1 16. A liquid crystal display device, as in claim 13, wherein the materials
2 selected for said alignment layer disposed on the lower assembly are different.

1 17. A liquid crystal display device, as in claim 13, wherein the materials
2 selected for said alignment layer disposed on the upper assembly are different.

1 18. A liquid crystal display device, as in claim 1, wherein said alignment layer
2 is treated such that a surface potential difference between the lower assembly
3 and the upper assembly, of said liquid crystal display device, is adjusted.

1 19. A method, as in claim 18, wherein said alignment layer is treated by
2 doping with an ionic salt, whereby the surface potential difference is changed.

1 20. A liquid crystal display device, comprising:
2 an upper electrode;
3 a lower electrode;
4 alignment layers in contact with at least one of said upper electrode or
5 said lower electrode to form an upper assembly and a lower
6 assembly; and
7 a liquid crystal display material, disposed between the upper assembly
8 and the lower assembly;
9 wherein the upper assembly and the lower assembly are designed relative
10 to each other to create a substantially predetermined surface
11 potential difference between the upper assembly and the lower
12 assembly;
13 such that an intrinsic DC offset potential in said liquid crystal display
14 device is within a designed range.

1 21. A method of measuring a surface potential of an assembly of a liquid
2 crystal display device, said method comprising:
3 connecting a terminal of an electric field measuring device to an electrode
4 of the assembly of the liquid crystal display device;
5 placing a measurement probe of the electric field measuring device
6 proximate to a surface of the assembly of the liquid crystal display
7 device; and
8 measuring the surface potential of the assembly of the liquid crystal
9 display device with the electric field measuring device.

- 1 22. A method of measuring a surface potential difference of a liquid crystal
- 2 display device, said method comprising:
 - 3 connecting a terminal of an electric field measuring device to an electrode
 - 4 from an upper liquid crystal display assembly;
 - 5 placing a measurement probe of the electric field measuring device
 - 6 proximate to a surface of the upper liquid crystal display assembly
 - 7 that will contact a first surface of a liquid crystal layer of the liquid
 - 8 crystal display device when assembled;
 - 9 measuring a surface potential of the surface of the upper liquid crystal
 - 10 display assembly with the electric field measuring device; and
 - 11 repeating said connecting, placing, and measuring relative to a lower
 - 12 liquid crystal display assembly to obtain a surface potential of the
 - 13 lower liquid crystal display assembly that will contact a second
 - 14 surface of the liquid crystal layer of the liquid crystal display device
 - 15 when assembled;
 - 16 such that when the surface potential of the upper liquid crystal display
 - 17 assembly and the surface potential of the lower liquid crystal
 - 18 display assembly are mathematically combined, the surface
 - 19 potential difference is obtained.
- 1 23. A method of changing an intrinsic DC offset potential in a liquid crystal
- 2 display device, said method comprising:
 - 3 selecting material for a lower electrode and an upper electrode, of the
 - 4 liquid crystal display device, such that a surface potential difference
 - 5 between a lower assembly and an upper assembly, of the liquid
 - 6 crystal display device, is adjusted and the intrinsic DC offset
 - 7 potential in the liquid crystal display device is changed.
- 1 24. A method of changing an intrinsic DC offset potential in a liquid crystal
- 2 display device, said method comprising:

3 selecting lower electrode material, for a lower assembly of the liquid
4 crystal display device, wherein the lower electrode material has a
5 measured surface potential; and
6 selecting upper electrode material, for an upper assembly of the liquid
7 crystal display device, having a surface potential that is
8 substantially similar to the surface potential of the lower electrode
9 material.

1 25. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 treating at least one electrode, of the liquid crystal display device, such
4 that a surface potential difference between a lower assembly and
5 an upper assembly, of the liquid crystal display device, is adjusted
6 and the intrinsic DC offset potential is changed.

1 26. A method, as in claim 25, wherein said treating further comprises firing at
2 least one electrode in an atmosphere selected from the group consisting of H₂,
3 N₂, and combination H₂/N₂.

1 27. A method, as in claim 25, wherein said treating further comprises etching
2 at least one electrode.

1 28. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 treating at least one electrode, of the liquid crystal display device, such
4 that a surface potential of the electrode is changed subsequent to
5 said treating.

1 29. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 selecting passivation layer material; and

1 disposing passivation layer material on an electrode, of the liquid crystal
2 display device to form an assembly;
3 wherein a surface potential of the assembly, after said disposing
4 passivation layer material, is altered;
5 such that a surface potential difference between a lower assembly and an
6 upper assembly, of the liquid crystal display device, is adjusted and
7 the intrinsic DC offset potential in the liquid crystal display device is
8 changed.

1 30. A method, as in claim 29, wherein a surface potential of the assembly
2 after said disposing passivation layer material, is altered resulting in a decrease
3 in the surface potential.

1 31. A method, as in claim 29, wherein a surface potential of the assembly
2 after said disposing passivation layer material, is altered resulting in an increase
3 in the surface potential.

1 1 32. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 selecting a passivation layer from at least one of BCB, NHC, MgO, SiO₂,
4 Al₂O₃, SiN₂, MgF₂, and MgAl₂O₄; and
5 disposing the passivation layer on at least one electrode to form an
6 assembly, wherein said disposing is selected from at least one of sputtering by
7 chemical vapor deposition (CVD), plasma-enhanced CVD, evaporation, spin-
8 coating, meniscus and roller-coating;
9 such that a surface potential difference between the assembly and a
10 second assembly of the liquid crystal display device, is adjusted.

1 33. A method, as in claim 32, further comprising said selecting a passivation
2 layer and said disposing the passivation layer to form the second assembly.

1 34. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 selecting alignment layer material; and
4 disposing alignment layer material on an electrode, of the liquid crystal
5 display device to form an assembly;
6 wherein a surface potential of the assembly after said disposing
7 alignment layer material, is altered;
8 such that a surface potential difference between a lower assembly and an
9 upper assembly, of the liquid crystal display device, is adjusted and
10 the intrinsic DC offset potential in the liquid crystal display device is
11 changed.

1 35. A method, as in claim 34, wherein a surface potential of the assembly
2 after said disposing alignment layer material, is altered resulting in a decrease in
3 the surface potential.

1 36. A method, as in claim 34, wherein a surface potential of the assembly
2 after said disposing alignment layer material, is altered resulting in an increase in
3 the surface potential.

1 37. A method, as in claim 34, wherein materials selected for alignment layer
2 disposed on the lower assembly are different

1 38. A method, as in claim 34, wherein materials selected for the alignment
2 layer disposed on the upper assembly are different.

1 39. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:
3 treating at least one alignment layer, of the liquid crystal display device,
4 such that a surface potential difference between a lower assembly
5 and an upper assembly, of the liquid crystal display device, is
6 adjusted

SEARCHED
INDEXED
MAILED
FILED

1 40. A method, as in claim 39, wherein said treating further comprises doping
2 the at least one alignment layer with an ionic salt, whereby the surface potential
3 difference is changed.

1 41. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:

3 increasing the thickness of at least one layer, applied to an electrode of
4 the liquid crystal display device, such that a surface potential
5 difference between a lower assembly and an upper assembly, of
6 the liquid crystal display device, is adjusted.

1 42. A method of changing an intrinsic DC offset potential in a liquid crystal
2 display device, said method comprising:

3 decreasing the thickness of at least one layer, applied to an electrode of
4 the liquid crystal display device, such that a surface potential
5 difference between a lower assembly and an upper assembly, of
6 the liquid crystal display device, is adjusted.

1 43. A liquid crystal display device, as in claim 13, wherein the materials
2 selected for said alignment layer disposed on the lower assembly are the same.

1 44. A liquid crystal display device, as in claim 13, wherein the materials
2 selected for said alignment layer disposed on the upper assembly are the same

1 45. A method, as in claim 34, wherein materials selected for the alignment
2 layer disposed on the lower assembly are the same.

1 46. A method, as in claim 34, wherein materials selected for the alignment
2 layer disposed on the upper assembly are the same.